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Botanical Composition of Plant Species on Rangeland Area at Cerra, Maradi

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Abstract: *This study assessed the flora species composition and range condition at CERRA, Maradi rangeland from Tarna village of Maradi Region in Niger Republic. Range factors used for the assessment include botanical composition of herbaceous (legumes and grasses) vegetation and woody (trees and shrubs) density on rangeland. Two (2) parallel transects were established within the rangeland which measures of 1015 m length by 500 m width. The interval between transect was 84.5 m. On each transect at 20 m interval, 10 m x 10 m land area was demarcated. Within each of the 100 m², five (5) 1 m² quadrats were randomly assigned per sampling unit, and the herbaceous layer was harvested. The plant species were identified by local name. The content of each quadrat (1 m x 1 m) was cut to 2 cm above ground level in each site. Results indicate that CERRA, Maradi rangeland a total of 20 legumes and 32 grasses plant species that belong to 8 families were identified each. However, the botanical composition of the woody plant species consisted of 14 woody plant species that belong to 8 families were identified. A total of 52 herbaceous plant species with a 3.57 diversity value were recorded on rangeland area. Distribution analysis of the herb species on rangeland area showed that the dominant species was Eragrotis tremula with an IVI value of 48.28. However, 29.17, 20.00 and 19.17% were observed in three plant species, namely Eragrotis tremula, Andropogon gayanus and Cenchrus biflorus, respectively. Cenchrus biflorus was found to have the highest density (11.28/m^2) followed by Eragrotis tremula (9.73/m^2) and Tephrosia uniflora (7.52/m^2). A total of 14 different woody plant species with a 2.61 diversity value were recorded on rangeland area. The maximum IVI distribution analysis of the woody plant species on rangeland area showed that the dominant species was Faidhebia albida with an IVI value of 86.67 and a 26.67% frequency. Acacia laeta and Faidhebia albida were recorded to have the highest and least distribution patterns, respectively.*

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I. Introduction

Rangeland resources are heterogeneous and dispersed, tied with seasonal rainfall patterns, differing through time and characterized by overall erratic climatic patterns (Ketema, et al., 2015). The net productivity of semi–arid rangelands is low and the animal and plant populations that it can sustain fluctuate unpredictably, depending on a number of variables among which rainfall patterns play a major role (Nori et al., 2008). The availability and quality of the different browse and grass species is believed to vary from season to season due to marked seasonality in rainfall distribution that affects the growth and development of the plant species, particularly that of the grasses and other herbaceous species (Abebe et al., 2012). Botanical composition is one of the means of studying ecological changes in the development of a rangeland (Malan and Niekerk, 2005). Botanical and chemical composition and season of growth affect the digestibility of grasses, and the nature and quantities of products of digestion (Dohme et al., 2006).The changes in the composition of plant species in savanna ecosystems have a significant influence on the sustainability of livestock production (Sankaran et al., 2005). The pastoral environment in West Africa is typified by semi–arid zones (MEL, 2008). The pastoral regions of Niger Republic, as elsewhere in Africa, have a fragile environment and unpredictable weather (USAID, 2014). The Maradi Region is endowed with a huge number of livestock and supports the livelihood of a larger segment of the society (MEL, 2011). However, studies on variations in botanical composition have not been done that would contribute to decision making regarding optimal utilization of the range resources. Therefore, the objective of this study was to undertake systematic assessments of the botanical composition of the herbaceous and woody plant species of the rangeland at CERRA, Maradi in Niger Republic.

II. Material And Methods

Description of the Study Area

The research was conducted on rangeland at CERRA, Maradi, which is located in Maradi LGA area of Maradi Region, about 15 km north-east of Madarounfa department along Tarna Road. A survey was carried out in September, 2016 for the purpose of identifying the area covered. A survey of vegetation was conducted where only lower layer cover was considered. This included the grasses, legumes and trees as well as shrubs up to a maximum height of one meter (1 m).

Herbaceous and Woody Vegetation Sampling

Two (2) parallel transects were established within the rangeland which was measured 1015 m length by 500 m width. The interval between transect was 84.5 m. On each transect at 20 m interval, 10 m x 10 m land area was demarcated. Within each of the 10 x 10 m, five (5) 1 m² quadrats were used to sample the botanical composition. The plant species were identified by local names. The content of each quadrat (1 m x 1 m) was cut to 2 cm above ground level in each site. The clipped herbage was separated into different plant species to determine botanical composition. Those species that were difficult to identify in the field, samples were collected, pressed and later taken to the herbarium of Institut National de la Recherche Agronomique du Niger (INRAN) where they were identified by matching with the herbarium specimens.

Within each of the 10 x 10 m quadrat, five 1 m x 1 m (1 m^2) quadrats were nested (four at the corners and one at the center) yielding 120 quadrats (24 plots x 5 quadrats). The number of individuals of each herb species and woody plant species were recorded. Then, the number of individual plant species was counted to estimate the diversity, frequency, density, abundance and IVI of vegetation. The basal cover of the woody plant species was estimated by measuring two canopy diameters at maximum and minimum diameters perpendicular to each other (Greig-Smith, 1983).

In each of the sample sites, the herbaceous vegetation was harvested at the ground level using hand shears from the five 1 m^2 nested quadrats to assess the dry matter biomass. The samples were packed into properly labeled plastic bags and immediately fastened and weighed using sensitive balance to record fresh weight and then transported to Animal Science Laboratory, Bayero University, Kano, Nigeria for determination of chemical constituents.

Data collection

All plant species in the quadrat (1 m x 1 m) was clipped and weighed to determine the fresh forage yield of the different quadrat per unit area (1 m^2) and were recorded in kg. However, Samples were then air dried under the shade and obtained the dry matter weight. Samples of local preferred plant species were collected from the field during the inventory. The plant species were identified through the assistance of cattle herders of CERRA, Maradi. Samples of plant species were collected and used for the laboratory analysis.

Statistical Analysis

The data was sorted out, coded and later analyzed using statistical package for social science (SPSS) version 20. Simple descriptive statistics of frequency and percentages were used for study. The data was analyzed using the General Linear Model (GLM) procedures of SPSS Version 20. For analyse, a P value <0.05 was considered statistically significant and a P value >0.05 was considered not significant. The plant species phytosociological characters were evaluated by analyzing the frequency, density, abundance and Importance Value Index (IVI) using a formula recommended by Mandal and Joshi, (2014)

Relative Frequency=(Frequency of plant species)/(Frequency of all plant species)x100

Relative density=(Number of individuals of plant species)/(Number of individuals of all plant species)x100

Relative Dominance of Herbaceous Plant Species=(Basal area of plant species)/(Basal area of all the plant species)x100

IVI = Relative frequency + Relative density + Relative dominance

IVI of woody plant species = Relative frequency + Relative density + Relative basal cover

The distribution of dominance of plant species in each plot was determined using IVI.

Moreover, the ratio of abundance to frequency (A/F) for different plant species was determined to elicit the distribution pattern.

The ratio of abundance to frequency indicates regular random (<0.050), contagious (0.050–1.00) and clump (>1.00) distribution patterns.

The diversity of the plant species was computed using the Shannon–Weiner index (H) and calculated as described by Krebs, (1999).

H'=∑_(i=1)^s⁡〖pi ln⁡pi 〗

Where s = number of plant species; pi = proportion of individuals or abundance of the ith plant speiecs; and ln is the natural logarithms to the base e.

Shannon–Weiner Index (H') was converted to effective number of plant species diversity (Jost, 2006) using the formula: N1=Exp(H^')
N1 = Effective number of plant species; H' = Shannon–Weiner function.
The proportion of the different plant species according to their desirability was calculated using percentage. All statistical analyses were performed using SPSS software version 20.

III. Result

Tables 1 indicated a total of 20 legumes plant species that belong to 8 families were identified, of which 10 (50%), 3 (15%) and 2 (10%) were *Fabaceae, Malvaceae* and *Rubiacea* respectively. *Cyperaceae, Asteraceae, Aizoaceae, Polygalaceae and Scrophulariaceae* had 5% each. In terms of the life forms, 17 (85%) were annuals and 3 (15%) perennials. A total of 32 grasses plant species that belong to 8 families were identified, of which 14 (43.8%) and 6 (18.8%) were *Poaceae* and *Convolvulaceae*, respectively. However, 3 (9.4%) was from *Euphorbiaceae* and *Cucurbitaceae* each. Also, 1 (3.1%) each was *Amaranthaceae, Asteraceae, Capparaceae, Cyperaceae, Pedaliaceae* and *Zygophyllaceae*. In terms of the life forms, 29 (90.6%) were annuals and 3 (9.4%) perennials.

Table 2 indicated the botanical composition of the woody plant species consisted of 14 woody plant species that belong to 8 families were identified, of which 7 (50%) were *Fabaceae* and *Bombacaceae, Meliaceae, Zygophyllaceae, Caesalpiniaceae, Cucurbitaceae Capparaceae* and *Ramnaceae* had 1 (7.14%) each. These were trees and shrubs each contributing 64.3% and 35.7% of the botanical group respectively.

Table 3 presented the diversity and dominance (IVI) of herbaceous plant species on rangeland area at CERRA, Maradi. A total of 52 herbaceous plant species with a 3.57 diversity value were recorded on rangeland area. Distribution analysis of the herb species on rangeland area showed that the dominant species was *Eragrotis tremula* with an IVI value of 48.28. The co-dominating plant species were *Cenchrus biflrous* (IVI =41.32), *Andropogon gayanus* (IVI = 33.90) and *Tephrosia uniflo*ra (IVI = 25.60). However, 29.17, 20.00 and 19.17% were observed in three plant species, namely *Eragrotis tremula, Andropogon gayanus* and *Cenchrus biflorus,* respectively. *Cenchrus biflorus* was found to have the highest density (11.28/m^2) followed by *Eragrotis tremula* (9.73/m^2) and *Tephrosia uniflora* (7.52/m^2).

Table 4 presented the diversity and dominance (IVI) of woody plant species on rangeland area at CERRA, Maradi. A total of 14 different woody plant species with a 2.61 diversity value were recorded on rangeland area. The maximum IVI distribution analysis of the woody plant species on rangeland area showed that the dominant species was *Faidhebia albida* with an IVI value of 86.67 and a 26.67% frequency. The co-dominant species were Acacia nilotica (IVI = 44.17) and *Balanites aegyptiaca* (IVI = 32.33). *Acacia laeta* and *Faidhebia albida* were recorded to have the highest and least distribution patterns, respectively.

Table no 1 : Identification of the legumes and grasses plant species on rangeland area.

N°	Local Name	Scientific Name	Family	Life Form
		Legumes plant species		
1	Gadagy	*Alysicarpus ovalifolius*	*Fabaceae*	A
2	Bakabiarana	*Crotalaria mucronata*	*Fabaceae*	A
3	Kaikaikomakanmachékya	*Crotalaria podocarpa*	*Fabaceae*	A
4	Dan madadahi	*Desmodium velutinum*	*Fabaceae*	P
5	Gemeenkusa	*Fimbristylis hispidula*	*Cyperaceae*	A
6	Yakwardaji	*Hibiscus asper*	*Malvaceae*	A
7	Rukumkasa	*Indigofera strobilifera*	*Fabaceae*	A
8	Nonanbarewa	*Lactuca taraxacifolia*	*Asteraceae*	A
9	Garkuwakusu	*Limeum pterocarpum*	*Aizoaceae*	A
10	Arwatsi	*Mitracarpus villosus*	*Rubiaceae*	A
11	Kahimalam	*Polygala erioptera*	*Polygalaceae*	A
12	Zamarake	*Sesbania leptocarpa*	*Fabaceae*	A
13	Tsu	*Sida alba*	*Malvaceae*	P
14	Garmani	*Sida corlifolia*	*Malvaceae*	P
15	Takorkodi	*Spermacoce radiata*	*Rubiaceae*	A
16	Gawguyé	*Striga hermonthica*	*Scrophulariaceae*	A
17	Kambolichaho	*Stylosanthese erecta*	*Fabaceae*	A
18	Tchintchyamahalba	*Tephrosia linearis*	*Fabaceae*	A
19	Margwa	*Tephrosia uniflora*	*Fabaceae*	A
20	Marak	*Zornia glochidiata*	*Fabaceae*	A
		Grasses plant species		
21	Mashinkadangaru	*Achyrantes aspera*	*Amaranthaceae*	A
22	Gomba	*Andropogon gayanus*	*Poaceae*	P
23	Farintchawa	*Aristida mutabilis*	*Poaceae*	A
24	Katsemu	*Aristida stipoides*	*Poaceae*	A
25	Garaji	*Brachiaria xantholeuca*	*Poaceae*	A
26	Karangya	*Cenchrus biflorus*	*Poaceae*	A

27	Karangyakura	*Cenchrus prieurii*	*Poaceae*	A
28	Yodo	*Ceratotheca sesamoïdes*	*Pedaliaceae*	A
29	Walkindamo	*Chrozophora senegalensis*	*Euphorbiaceae*	A
30	Damaïgi	*Chrozophora brocchiana*	*Euphorbiaceae*	A
11	Kafurdo	*Citrillus colocynthis*	*Cucurbitaceae*	A
12	Gashyamahalba	*Cleome viscosa*	*Capparaceae*	A
13	Guna	*Colocynthis vulgaris*	*Cucurbitaceae*	A
14	Balasa	*Commelina forskoalei*	*Poaceae*	A
15	Guna zaki	*Cucumis prophetarum*	*Cucurbitaceae*	P
16	Gira giri	*Cyperus rotundus*	*Cyperaceae*	A
17	Gudagude	*Dactyloctenium aegyptium*	*Poaceae*	A
18	Sorandi	*Dicoma tomentose*	*Asteraceae*	A
19	Arthyia	*Digitaria horizontalis*	*Poaceae*	A
20	Tsitsiya (komaya)	*Eragrotis tremula*	*Poaceae*	A
21	Tchap	*Euphorbia forskalii*	*Euphorbiaceae*	A
22	Yalyadi	*Ipomoea vagans*	*Convolvulaceae*	A
23	Dumankada	*Ipomoea asarifolia*	*Convolvulaceae*	A
24	Tara tara	*Ipomoea pes-tigridis*	*Convolvulaceae*	A
25	Kukumbara	*Jacquemontia tamnifolia*	*Convolvulaceae*	A
26	Gamonfulani	*Merremia pimata*	*Convolvulaceae*	A
27	Yambururu	*Merremia tridentata*	*Convolvulaceae*	A
28	Tchintchyaruwa	*Panicum subalbidum*	*Poaceae*	A
29	Farintchawa	*Schoenefeldia gracilis*	*Poaceae*	A
30	Datannia	*Thelepogon elegans*	*Poaceae*	P
31	Harkia	*Tragus racemosus*	*Poaceae*	A
32	Tsaydo	*Tribulus terrestris*	*Zygophyllaceae*	A

A= Annual; P = Perennial

Table no 2 : Woody plant species (tree and shrub) on rangeland area

N°	Local Name	Scientific Name	Family	Botanical Group
1	Akkora	*Acacia laeta*	*Fabaceae*	T
2	Bagaruwa	*Acacia nilotica*	*Fabaceae*	T
3	Erchi	*Acacia seyal*	*Fabaceae*	T
4	Kuka	*Adansonia digitata*	*Bombacaceae*	T
5	Mena	*Azadirachta indica*	*Meliaceae*	T
6	Aduwa	*Balanites aegyptiaca*	*Zygophyllaceae*	T
7	Jirga	*Bauhinia rufescens*	*Fabaceae*	S
8	Takwasara Madaoua	*Cassia mimosoïdes*	*Caesalpiniaceae*	S
9	Farakaya	*Combretum nigricans*	*Cucurbitaceae*	S
10	Gao	*Faidhebia albida*	*Fabaceae*	T
11	Jiga	*Maerua crassifolia*	*Capparaceae*	S
12	Kalgo	*Piliostigma reticulatum*	*Fabaceae*	T
13	Tsamia	*Tamarindus indica*	*Fabaceae*	T
14	Magarya	*Ziziphus mauritiana*	*Ramnaceae*	S

T = Tree; S = Shurb

Table no3: Diversity and dominance (IVI) of herbaceous plant species on rangeland area.

Plant Species	Abundance	Relative Frequency	Relative Density	A/F	IVI
High Dominance Herbs					
Eragrotis tremula	33.38	29.17	9.73	1.14	48.28
Cenchrus biflrous	58.87	19.17	11.28	3.07	41.32
Andropogon gayanus	35.40	20.00	7.08	1.77	33.90
Tephrosia uniflora	69.43	10.83	7.52	6.41	25.60
Medium Dominance Herbs					
Alysicarpus ovalifolius	60.68	5.83	3.54	10.40	12.78
Sida corlifolia	46.46	6.67	3.10	6.97	12.75
Crotalaria mucronata	39.82	6.67	2.65	5.97	11.88
Euphorbia forskalii	29.50	7.50	2.21	3.93	11.84
Dicoma tomentose	45.51	5.83	2.65	7.80	11.05
Merremia tridentata	45.51	5.83	2.65	7.80	11.05
Fimbristylis hispidula	41.72	5.83	2.43	7.15	10.61
Schoenefeldia gracilis	48.67	5.00	2.43	9.73	9.78
Mitracarpus villossus	34.13	5.83	1.99	5.85	9.74
Citrillus colocynthis	23.23	6.67	1.55	3.48	9.71
Ipomae vagans	30.34	5.83	1.77	5.20	9.31
Hibiscus asper	39.82	5.00	1.99	7.96	8.91
Thelepogon elegans	39.82	5.00	1.99	7.96	8.91
Jacquemontia tamnifolia	39.82	5.00	1.99	7.96	8.91
Digitaria horizontalis	53.10	4.17	2.21	12.74	8.51
Desmodium velutinum	35.40	5.00	1.77	7.08	8.48
Zornia glochidiata	35.40	5.00	1.77	7.08	8.48
Dactyloctenium aegyptium	35.40	5.00	1.77	7.08	8.48
Cucumis prophetarum	22.76	5.83	1.33	3.90	8.44

Spermacoce radiata	42.48	4.17	1.77	10.19	7.64
Ipomoea pes-tigridis	37.17	4.17	1.55	8.92	7.21
Commelina forskoalei	22.12	5.00	1.11	4.42	7.17
Ipomoea asarifolia	31.86	4.17	1.33	7.65	6.77
Cyperus rotundus	31.86	4.17	1.33	7.65	6.77
Colocynthis vulgaris	46.46	3.33	1.55	13.94	6.37
Merremia pimata	46.46	3.33	1.55	13.94	6.37
Chrozophora brocchiana	21.24	4.17	0.88	5.10	5.90
Crotalaria Podocarpa	21.24	4.17	0.88	5.10	5.90
Sesbania leptocarpa	33.19	3.33	1.11	9.96	5.51
Aristida stipoides	15.93	4.17	0.66	3.82	5.47
Striga hermonthica	44.25	2.50	1.11	17.70	4.67
Ceratotheca sesamoïdes	44.25	2.50	1.11	17.70	4.67
Aristida mutabilis	19.91	3.33	0.66	5.97	4.64
Chrozophora senegalensis	19.91	3.33	0.66	5.97	4.64
Least Important Herbs					
Brachiaria xantholeuca	17.70	2.50	0.44	7.08	3.37
Cenchrus prieurii	17.70	2.50	0.44	7.08	3.37
Cleome viscosa	39.82	1.67	0.66	23.89	2.97
Tribulus terrestris	39.82	1.67	0.66	23.89	2.97
Achyrantes aspera	53.10	0.83	0.44	63.72	1.70
Lactuca taraxacifolia	53.10	0.83	0.44	63.72	1.70
Panicum subalbidum	53.10	0.83	0.44	63.72	1.70
Sida alba	53.10	0.83	0.44	63.72	1.70
Tephrosia linearis	26.55	0.83	0.22	31.86	1.27
Tragus racemosus	26.55	0.83	0.22	31.86	1.27
Indigofera strobilifera	26.55	0.83	0.22	31.86	1.27
Lemium pterocarpum	26.55	0.83	0.22	31.86	1.27
Polygala erioptera	26.55	0.83	0.22	31.86	1.27
Stylosanthes erecta	26.55	0.83	0.22	31.86	1.27

A/F = abundance to frequency ratio; IVI = Importance Value Index.

Table no 4 Diversity and dominance (IVI) of woody plant species on rangeland area**.**

Plant Species	Abundance	Relative Frequency	Relative Density	A/F	IVI
Faidhebia albida	1.13	26.67	30.00	0.04	86.67
Acacia nilotica	1.54	10.83	16.67	0.14	44.17
Balanites aegyptiaca	1.44	8.33	12.00	0.17	32.33
Azadirechta indica	1.09	9.17	10.00	0.12	29.17
Cassia mimosoïdes	1.10	6.67	7.33	0.17	21.33
Maerua crassifolia	1.20	5.00	6.00	0.24	17.00
Tamarindus indica	1.20	3.33	4.00	0.36	11.33
Acacia seyal	0.80	4.17	3.33	0.19	10.83
Bauhinia rufescens	1.07	2.50	2.67	0.43	7.83
Piliostigma reticulatum	0.80	3.33	2.67	0.24	8.67
Adansonia digitata	1.20	1.67	2.00	0.72	5.67
Combretum nigricans	0.80	1.67	1.33	0.48	4.33
Ziziphus mauritiana	0.80	1.67	1.33	0.48	4.33
Acacia laeta	0.80	0.83	0.67	0.96	2.17

A/F = abundance to frequency ratio; IVI = Importance Value Index.

IV. Discussion

A total of fifty four (54) herbaceous plant species that belong to twenty (20) families were identified and reported. Most herbaceous identified includes legumes and grasses. During the inventory, desirable and highly nutritious grass species like *Cenchrus biflorus* turned out to be the dominant species despite the selection pressure inflicted by herbivores. This anomaly whereby the highly desirable and nutrient–rich species such as *Cenchrus biflorus* became abundant in areas where grazing pressure was high might be related to the prostrate and short–stature growth habit. Also, herbaceous legumes can contribute to soil protection. This is in agreement with the report by O'Connor et al., (1995); Treydte et al., (2006) and Haftay et al., (2013). Similarly, Van der Westhuizen et al. (2005) and Tefera et al. (2007) noted that *Cenchrus biflorus* was rather the dominant key species in rangelands that are severely overgrazed. On rangeland, majority were the less desirable semi–arid zone annual legume *spermacoce* radiate is commonly and dominantly distributed throughout rangeland. The highly desirable grass species such as *Andropogon gayanus, Merremia tridentate, Eragrotis tremula, Euphorbia forskalii* and *Ipomae vagans* were distributed in few grazing areas on the rangeland. Their annual form of life, as indicated by Gemedo–Dalle et al., (2006) and Haftay et al., (2013) seems to be responsible for such limited spatial distribution in relation to the grazing pressure and this can be taken as an indicator of the rangeland deterioration. However, overgrazing affects the botanical composition and species diversity by depressing the vigor of dominant species, which then enables colonization by less competitive, but grazing tolerant plant species (Sternberg et al., 2000). The botanical composition of the woody plant species consisted of 150 species

that belong to 10 families on rangeland at CERRA, Maradi. These were trees and shrubs each contributing 57.14% and 42.86% of the botanical group respectively. Trees and shrubs are important sources of fodder for livestock in the semi-arid zone and climatic conditions better than herbaceous species (Silanikove et al., 1996). Acacia woodlands represent one of the most widespread vegetation types of semi–arid areas in Africa (Traoré et al., 2012). The woody plant species on rangeland at CERRA, Maradi are mainly of trees such as *Faidherbia albida, Balanites aegyptiaca, Acacia nilotica* and *Azadirachta indica* and shrubs like *Cassia mimosoîdes, Maerua crassifolia* and *Piliostigma reticulatum. However, Faidherbia albida* which is dominant in woodlands and forests also reported to be native to many dry areas in southern of the Sahel, to eastern and southern Africa (ILDIS, 2013). Similarly, *Acacia seyal* is widely distributed in the African savannah where it is one of the most common trees on clay plains that flood during the rainy season. Several species of *A. seyal* have been recognized by grazers because of their feeding value during the drought (Olivers–Pérez et al., 2013). It has been reported that the pods and leaves of *A. seyal* are nutritious and palatable to livestock (Orwa et al., 2009; Abdalla et al., 2014). *Balanites aegyptiaca* was found to be dominant in the study area. There are reports that supported the wide distribution of *B. aegyptiaca*. Sands, (2001) noted that *B. aegyptiaca* was one of the most widely distributed trees in the dryland of Africa. *Tamarindus indica* has a wide geographical distribution in the arid and semi–arid zones (El-Siddib et al., 2006). Similarly, this tree species did appear in the rangeland of the study area. However, analysis of IVI provides information about the social status of plant species and can be recognized as patterns of association of dominant plant species on rangeland (Parthasarathy, et al., 1997). Analysis of IVI on rangeland represented different combinations of species with different dominants and co-dominants. Eragrotis *tremula, Cenchrus biflorus, Tephrosia uniflora,* and *Andropogon gayanus* were found to be the most dominant herbaceous plant species on rangeland area. Supporting the findings of Mandal et al., (2014) on rangeland area, the findings in the current study suggest that vegetation experiencing stresses from biotic pressure are under serious threat. However, some of the herbaceous plant species on rangeland area have managed to survive the pressure. In relation to this, McGranahan et al., (2013) noted that grazing might be associated with variation in plant community composition within vegetation states. Variation of herb distribution in rangeland area may be attributed to the survival and reproduction of maximum species due to moderate level of species competition during early regeneration which has led to the domination of only a few species. Validating this finding, Grime, (1973) noted that with an increase in environmental stress, the species adapted to low levels of environmental stress lose their competitive advantage whereas those that are more resistant to environmental stress can increase in abundance. It is uncertain, however, the extent to which the smallest differences between samples of vegetation are environmentally determined and the extent to which they affect the chances of species establishing themselves (McNaughton, et al., 1970). The distribution of patterns (A/F ratio) for most of the plant species showed contiguous growth patterns followed by a clumped distribution pattern. According to Odum, (1971), contiguous distribution is the most common pattern in nature and is formed as a result of small but significant variations in the ambient environmental conditions. Variations in the distribution pattern among site and vegetation composition are associated with micro environmental and biotic factors (Singhal, et al., 1989). Ideally, biomass estimation methods would express relationships between actual and estimated biomass with high precision (Tadmor et al., 1975) and accuracy (Hutchings et al., 1969) with intercepts that pass through or close to the origin (Carpenter et al., 1987).

V. Conclusion

Results in the present study revealed that there was the botanical composition of important forage species in the rangeland at CERRA, Maradi. Moreover, the composition of the herbaceous and woody plant species in the study area includes predominantly grasses, legumes, leaves and pods that are grazed or have potential to be grazed. This rangeland is used as a natural ecosystem for the survival of grazing herds of domestic ruminants.

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References

[1]. Abdalla, M. S., Babiker, I. A., Idris, A. M. and Elkalifa, K. F. Potential nutrient composition of Acacia seyal fruits as fodder for livestock in the drylands in Sudan. Department of Analytical Chemistry, 2014; 1: 25−30.

[2]. Abebe, A., Tolera, A. Holand, Ø., Adnøy, T. and Eik, L.O.. Seasonal variations in nutritive value of some browse and grass species in Borana rangeland, southern Ethiopia. Tropical and Subtropical Agro ecosystems. 2012; 15: 261- 271.

[3]. Awa, D. N., Njoya, A., Logtene, Y. M., Ndomadji, J. A., Onana, J., Asongwed-Awa, A., Tama C. A. N., Djoumessi, M., Loko, B., Bechir, A. B., Delafosse, A. and Maho, A. Livestock production systems in the semi-arid savannah of the Central African sub-region. 2002; Pp154

[4]. Awas, T., T. Bekele and S. Demissew. An ecological study of the vegetation of Gambella Region, Southwestern Ethiopia. Ethiopian Journal Science. 2001; 24(2): 213-228.

[5]. Carpenter, A. T., and West, N. E. Validating the reference unit method of aboveground phytomass estimation on shrubs and herbs. Vegetation. 1987; 72: 75−79.

[6]. Cavalcante, A.C.R., Araújo, J.F., Do, M., Carneiro, S., Souza, H. A., Tonucci, R. G., Rogerio, M. C. P. and Vasconcelos, E. C. G. Potential use of tropical grass for deferment in Semi-Arid Region. American Journal of Plant Science. 2014; 5: 907−914.

[7]. Dohme, F., C.M. Graf, Y. Arrigo, U. Wyss and M. Kreuzer. Effect of botanical characteristics, growth stage and method of conservation on factors related to the physical structure of forage- An attempt towards a better understanding of the effectiveness of fiber in ruminants. Animal and Feed Science of Technology. 2006; 138(3): 205-227.

[8]. ECOCROP Database. The Crop Environmental Requirements Database and the Crop Environmental Response Database. FAO. 2004

[9]. Egeru, A., Wasonga, O., Kyagulanyi, J., Majaliwa, G. J. M., MacOpiyo, L. and Mburu, J. Spatio-temporal dynamics of forage and land cover changes in Karamoja sub-region, Uganda. Pastoralism: Research, Policy and Practice. 2014; 4: 6.

[10]. El-Siddig, K., Gunasena, H. P. M., Prasad, B. A., Pushpakumara, D. K. N. G., Ramana, K. V. R., Vijayanand, P. and Williams, J. T. Tamarind, Tamarindus indica. In: Williams J.T., Smith R.W., Haq, N. and Dunsiger, Z. (Edition.). Southampton Centre for Underutilized Crops, Southampton, UK. 2006; 188pp.

[11]. Friis, I. Forests and forest trees of northeast tropical Africa: Their natural habits and distribution patterns in Ethiopia, Dijibouti and Somalia. Her Majesty's Stationary Office, London. 1992

[12]. Fuglie, I. Producing food without pesticides, Local solution to crop pest control in West African, Centre for Technical Agricultural and Rural Cooperation (Ede NetherLands). 1991

[13]. Gemedo-Dalle, T., Maass, B. L. and Isselstein, J. Rangeland condition and trend in the semi-arid Borana lowlands, Southern Oromia, Ethiopia. African Journal of Range and Forage Sciences. 2006; 23: 49-58.

[14]. Grime, J. D. Control of species diversity in herbaceous vegetation. Journal of Environmental Management. 1973; 1:151–167.

[15]. Haftay, H., Yayneshet, T., Animut, G. and Treydte, A. C: Rangeland vegetation responses to traditional enclosure management in eastern Ethiopia. The Rangeland Journal. 2013; 35: 29−36.

[16]. Homewood, K.M. Ecology of African Pastoralist Societies. Oxford, James Curry. 2008

[17]. Hussain, F. and Durrani, M. J. Seasonal availability, palatability and animal preferences of forage plants in Harboi arid range land, Kalat, Pakistan. Pakistan Journal of Botany. 2009; 41 (2): 539−554.

[18]. Hutchings, S. S., and Schmautz, J. E. A field test of the relative-weight-estimate method for determining herbage production. Journal of Range Management. 1969; 22:408−411.

[19]. Keba, H. T., Madakadze, I. C., Angassa, A. and Hassen, A. Nutritive value of grasses in semi-arid rangelands of Ethiopia: Local experience based herbage preference evaluation versus laboratory analysis. Asian-Australasian Journal of Animal Sciences. 2013; 26: 366-377.

[20]. Kelbessa, E., S. Demissew, Z. Woldu and S. Edwards. Some threatened endemic plants of Ethiopia. NAPRECA Monograph Series. 1992; 2:35-55.

[21]. Ketema, T., Ashenafi, M. and Solomon, M. Seasonal Dynamics in Botanical Composition of the Rangelands of Gambella, Southwestern Ethiopia. The Journal of Agriculture and Natural Resources Sciences. 2015; 2(1): 267-280

[22]. Krebs, C.J. Ecological Methodology; University of British Colombia: Vancouver, BC, Canada. 1999

[23]. Malan, P. W., and Niekerk, V. The extent of grass species composition in Braklaagte, Zeerust District, North-West Province, South Africa. African Journal of Range Forage Science. 2005; 22(3): 177- 184.

[24]. Mandal, J.; Joshi, S.P. Analysis of vegetation dynamics and phytodiversity from three dry deciduous forests of Doon Valley, Western Himalaya, India. Journal of Asia–Pacific Biodiversity. 2014; 7: 292–304.

[25]. McGranahan, D. A.; David, M. E.; Samuel, D. F.; James, R. M. and Diane, M. D. Multivariate analysis of rangeland vegetation and soil organic carbon describes degradation, informs restoration and conservation. Land. 2013; 2, 328–350.

[26]. McNaughton, S. J.; and Wolf, L. L. Dominance and the niche in ecological systems. Science.1970; 167, 131–139.

[27]. Nori, M., Taylor, M. and Sensi, A. Browsing on fences. Pastoral land rights, livelihoods and adaptation to climate change. IIED (International Institute for Environment and Development). 2008; 28-148.

[28]. O'Connor, T. G. and Roux, P. W. Vegetation changes (1949-71) in a semi-arid, grassy dwarf shrub land in the Karoo, South Africa: Influence of rainfall variability and grazing by sheep. Journal of Applied Ecology. 1995; 32: 612–626.

[29]. Odum, E. P. Fundamentals of Ecology, 3rd Edition; Saunders: Philadelphia, PA, USA. 1971

[30]. Olivares-Pérez, J., Avilés-Nova, F., Albarrán-Portillo, B., Castelán-Ortega, O. A. and Rojas-Hernández, S. Nutritional Quality of Pithecellobium Dulceand Acacia cochliacantha Fruits, and its Evaluation in Goats. Livestock Science. 2013; 154: 74–81.

[31]. Orwa, C., Mutua, A., Kindt, R., Jamnadass, R. and Anthony, S. Agroforestry Database: a Tree Reference and Selection Guide. Version 4.0, World Agroforestry Centre, Kenya. 2009

[32]. Parthasarathy, N. and Karthikeyan, R. Biodiversity and population density of woody species in a tropicalevergreen forest in Courtallum reserve forest, Western Ghats, Indian Journal of Tropical Ecology.1997; 38 : 297–306.

[33]. Sands, M. J. The desert date and its relatives: A revision of the genus Balanites. Kew Bulletin. 2001; 56: 1–128.

[34]. Sankaran, M., N.P. Hanan, R.J. Scholes, J. Ratnam, D .J. Augustine, B.S. Cade, J. Gignoux, S.I. Higgins, X. Le Roux, F. Ludwig, J. Ardo, F. Banyikwa, A. Bronn, G. Bucini, K.K. Caylor, M.B. Coughenour, A. Diouf, W. Ekaya, C.J. Feral, E.C. February, P.G.H. Frost, P. Hiernaux, H. Hrabar, K.L. Metzger, H.H.T. Prins, S. Ringrose, W. Sea, J. Tews, J. Worden and N. Zambatis. Determinants of woody cover in African savannas. Nature. 2005; 438:846-849.

[35]. Silanikove, N., Gilboa, N., Nir, I., Perevolotzky, A. and Nitsan, Z. Effect of daily supplementation of polyethylene glycol on intake and digestion of tannin-containing leaves (Quercus calliprinos, Pistacia lentiscus and Ceratonia siliqua) by goats. Journal of Agriculture and Food Chemistry, 1996; 44: 199–205.

[36]. Singhal, R. M. and Soni, S. Quantitative ecological analysis of some woody species of Mussoorie Himalayas. Indian Forums, 1989; 115, 327–336.

[37]. Sternberg, M., Gutman, M., Perevolotsky, A., Ungar, E. D. and Kigel J. Vegetation response to grazing management in a Mediterranean herbaceous community: A functional group approach. Journal of Applied Ecology. 2000; 37: 224–237.

[38]. Tadesse, M. A survey of evergreen forests of Ethiopia. NAPRECA Monograph Series. 1992; 2: 1- 18.

[39]. Tefera, S., Snyman, H. A. and Smit, G. N. Rangeland dynamics in southern Ethiopia: (1) Botanical composition of grasses and soil characteristics in relation to land-use and distance from water in semi-arid Borana rangelands. Journal of Environmental Management, 2007; 85: 429–442.

[40]. Tilahun, K. Biomass production, utilization practices and range condition in Nuer Zone of Gambella, Ethiopia. M.Sc Thesis. Haramaya Univ., Ethiopia. 2007

[41]. Tolera, A., Khazal, K. and Ørskov, R.. Nutritive evaluation of some browse species. Animal Feed Science and Technology. 1997; 67: 181–195
[42]. Traoré, S., Zerbo, L., Schmidt, M. and Thiombiano, L. Acacia communities and species responses to soil and climate gradients in the Sudano-Sahelian zone of West Africa. Journal of Arid Environment. 2012; 87: 144–152.
[43]. Treydte, A. C., Bernasconi, S. M., Kreuzer, M. and Edwards, P. J. Diet preferences of the common warthog on nutrient-enriched former cattle grounds on a coastal savanna in Tanzania. Journal of Mammalogy. 2006; 87: 889–898.
[44]. USAID. Climate Change and Conflict in the Sahel: Findings from Niger and Burkina Faso. Tetra Tech ARD, through a Task Order under the Prosperity, Livelihoods, and Conserving Ecosystems (PLACE) Indefinite Quantity Contract Core Task Order. 2014; 59pp
[45]. Van Der Westhuizen, H. C., Snyman, H. A. and Fouche, H. J. A degradation gradient for the assessment of rangeland condition of a semi-arid sourveld of southern Africa. African Journal of Range and Forage Science. 2005; 22: 47–59.

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